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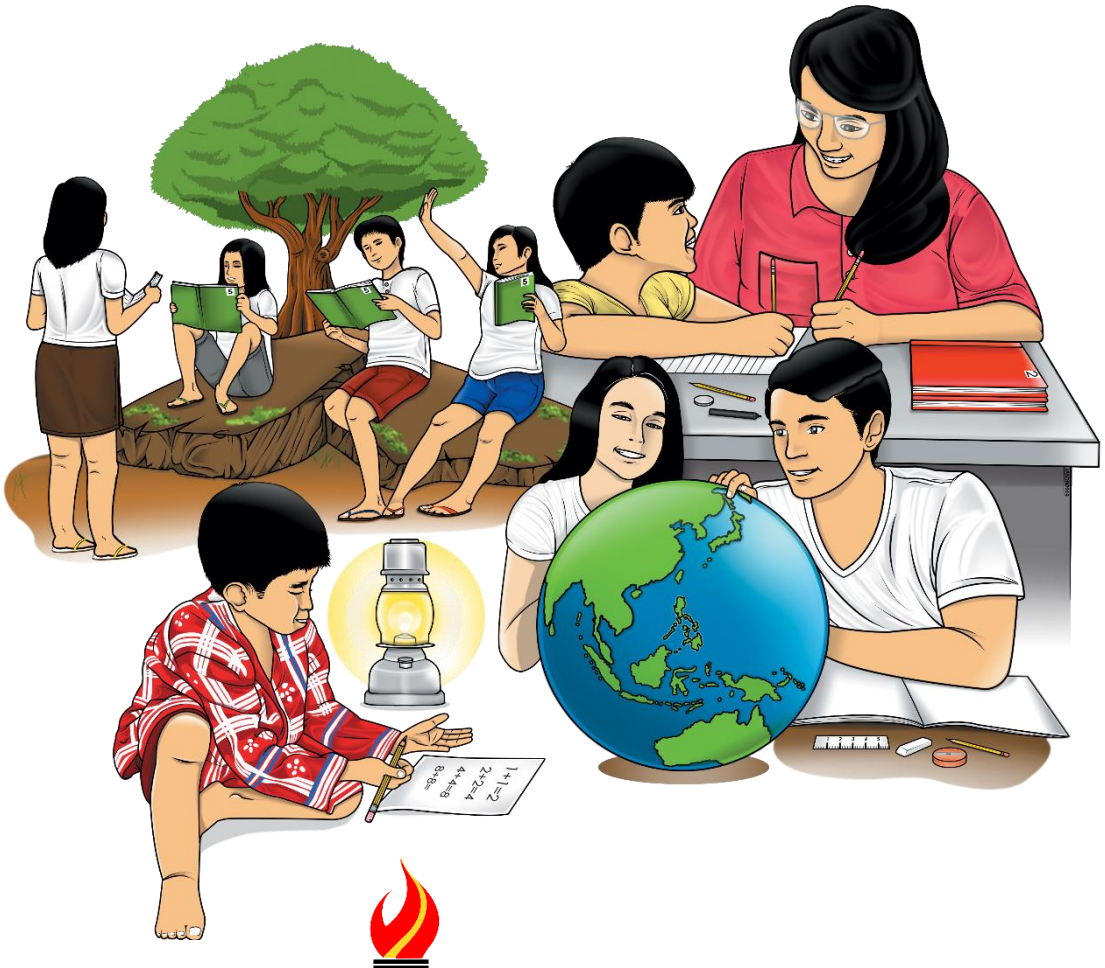
DEPARTMENT OF EDUCATION

Science
Quarter 2- Matter
Module 1: Electronic Structure of Matter



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Science
Quarter 2- Matter
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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

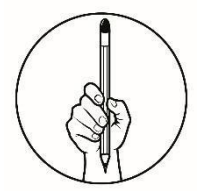
This module is designed and written with you in mind. It is here to help you master Electronic Structure of Matter. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course, but the order in which you read them can be changed to correspond with the textbook you are now using.

The module focuses on achieving this learning competency:

Explain how the Quantum Mechanical Model of the atom describes the energies and positions of the electrons. (S9MT-IIa-22)

After going through this module, you are expected to:

- predict the probable location of the electron/s in an atom (electron cloud, Heisenberg's Uncertainty Principle);
- describe electron configuration and write the correct electron configuration of the given element;
- describe the set of quantum numbers and complete the given set of quantum numbers for each given element; and
- supply the following data from the electron configuration such as: period number, group number, number of paired and unpaired electrons, number of valence electrons and number of core electrons.



What I Know

Choose the letter of the best answer. Write your answer on a separate sheet of paper.

1. Who formulated the "Uncertainty Principle"?
   A. Erwin Schrodinger
   B. James Maxwell
   C. Louise de Broglie
   D. Werner Heisenberg

2. Where are the electrons usually found according to the atomic theory?
   A. In the atomic nucleus.
   B. Outside the nucleus, most of an atoms' volume is the electron cloud.
   C. Outside the nucleus, yet near it because they are attracted to protons.
   D. Anywhere they want to be – no particular location is more likely than any other.

3. What is the region around the atomic nucleus where the electron is mostly found?
   A. Frequency
   B. Energy Level
   C. Atomic Orbital
   D. Atomic Emission Spectrum

4. Which shows the correct order in the following atomic orbitals?
   A. f orbital, d orbital, p orbital, s orbital
   B. p orbital, f orbital, s orbital, d orbital
   C. s orbital, d orbital, f orbital, p orbital
   D. s orbital, p orbital, d orbital f orbital

5. Which of the following is the lowest value of that the principal quantum number may have?
   A. 0 B. 1 C. 2 D. 3

6. How many electrons could be held in the second shell of an atom if the spin quantum number m_s could have three values instead of just two? (Hint: Consider the Pauli exclusion principle)
   A. 12
   B. 15
   C. 20
   D. 24

7. What is the group and period of an element with an electronic configuration of $1s^2\ 2s^2\ 2p^6$?
   A. Group 2 period 3
   B. Group 4 period 2
   C. Group 8 period 2
   D. Group 8 period 4

8. Which orbital designation has the highest energy?
   A. 2s B. 2p C. 3d D. 4s

9. What occurs when an electron moves from high- energy level to a low one?
   A. The atom moves faster
   B. Colored light is given off
   C. This process is not possible
   D. Another electron goes from a low energy level to a high one.

10. Which explains the filling up of the orbital in the order of increasing energy?
   A. Octet Rule
   B. Hund's Rule
   C. Pauli's Exclusion
   D. Aufbau Principle

11. Which among the following shows that an atom is stable?
   A. With 6 valence electrons
   B. With 8 valence electrons
   C. With 10 valence electrons
   D. With 12 valence electrons

12. Who proposed the probability that electrons can be found in certain locations around the nucleus of an atom?
   A. Neil's Bohr
   B. Ernest Rutherford
   C. Erwin Schrodinger
   D. Joseph John Thomson

13. Based on Rutherford's atomic model, which sub-atomic particle is present in the nucleus of an atom?
   A. Proton only
   B. Proton and Neutron
   C. Neutron and Electron
   D. Proton and Electron

14. Which of the following postulates explain that no two electrons can have the same set of four quantum numbers?
    A. Hund's Rule
    B. Aufbau principle
    C. Dalton's Atomic Theory
    D. Pauli's Exclusion Principle

15. How many orbitals are on the third principal energy level?
    A. 2
    B. 3
    C. 6
    D. 9

Lesson 1 Electronic Structure of Matter

When you were in Grade 8 you have learned that the atomic model of Rutherford shows that the atom is mostly an empty space and its mass is concentrated at the center of an atom. You also learned that light is composed of different wavelength and frequencies. The frequency of the color of the lights is inversely proportional to the wavelength. In this module, you will learn about the model of the atom, which is called the quantum atomic model, the probability of finding the location of electrons, and the different types of quantum numbers and its description.

Here are some key questions for you to ponder after finishing this module:

1. How does Bohr's atomic model different from Rutherford's atomic model?
2. What is the basis for the quantum mechanical model of the atom?
3. How are the electrons arranged in an atom?
4. What is the basis of such arrangement?
5. What is the information that can be gathered from the electron configuration of an atom?

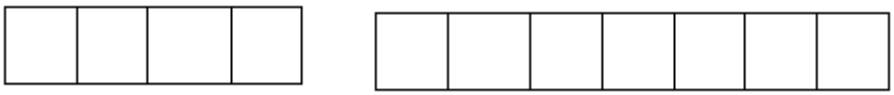
What's In

Let's recall your understanding on the concepts of atom. Identify the word being described on the following items. Write your answers on a separate sheet of paper.

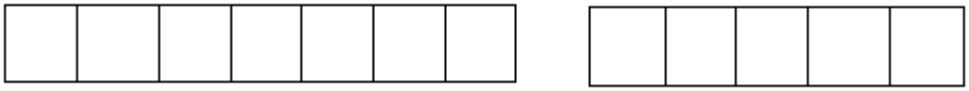
1. The charge of an atom where the electron is equal to the number of protons.

2. The part of the atom where the mas is concentrated.

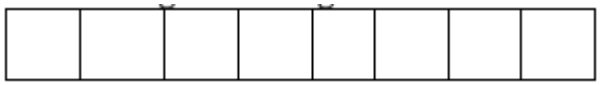
3. It is known as the atomic model of Joseph Thomson.



4. The atomic model of Rutherford using gold foil experiment.



5. The negative charge of an atom.



What's New

Match each word in the box to the descriptions below. Write the letter of the correct answer on a separate sheet of paper.

A. Orbital	D. Electron Density
B. Electronic Configuration	E. Quantization of Energy
C. Aufbau Principle	F. Wave

_____ 1. The probability of finding the electron.

_____ 2. A disturbance that transmit energy through a medium.

_____ 3. A region around the nucleus where the electrons most likely be found.

_____ 4. The orderly distribution of electrons among the orbitals of an atom.

_____ 5. It led to the present model of an atom.

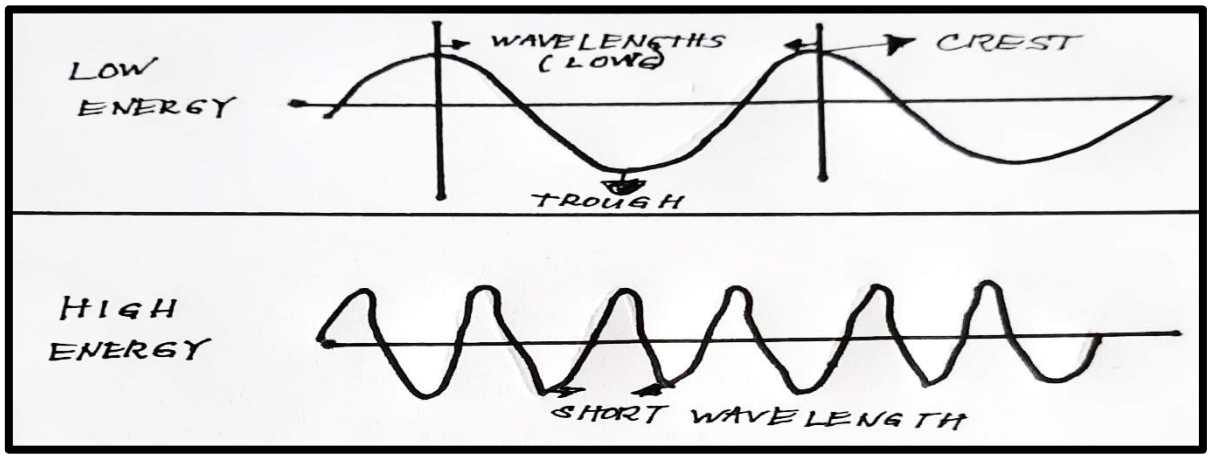
_____ 6. It requires that the electrons occupy the lowest possible energy level before filling up the next level.

What is It

The Electronic Structure of Matter

Joseph John Thomson conducted an experiment using the cathode ray tube. His experiments resulted in the discovery of the electron. He named his atomic model as the nuclear model of the atom. During the fireworks display we are amazed in the different colors of its flame and this is because it is made up of different metallic elements that releases by different amount of energy when it absorbed the heat and that is because of the excited electrons. This determines the color or the wavelength of the light emitted. For example, when barium chloride heated it produces green color because the metallic element barium is responsible for that color while copper chloride produces a blue color because the metallic copper emits that color.

Light is a radiant energy travelling in space through a wave form. Each radiation is characterized by a wavelength and amplitude. The wavelength is the distance between two successive crests while the amplitude is the height of the wave. The wavelength determines the amount of energy it carries. The shorter the wavelength the higher the energy.

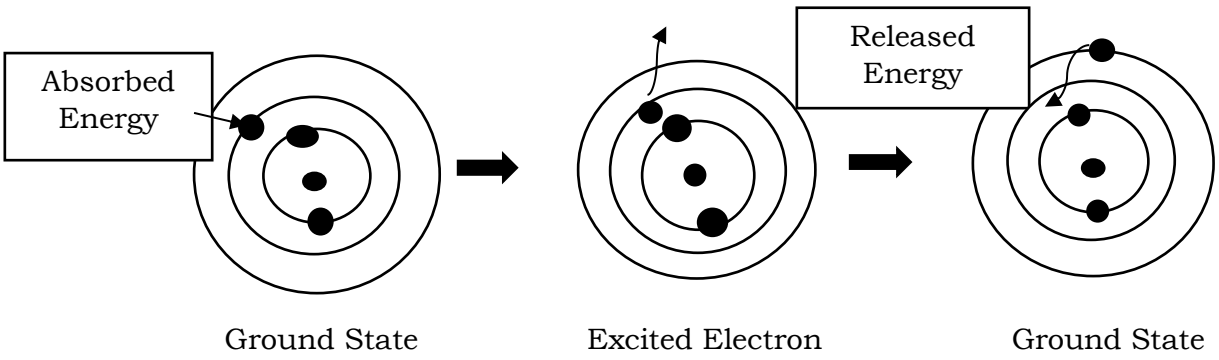


A glass prism can be used to separate the components of light. The white light from the sun produces different colors of the spectrum that shows the different wavelengths similar to a rainbow. A flame test could be used to identify the elements and the energy it produced.

Example:

Name of elements	Flame Color
1. Sodium	Yellow
2. Copper	Green
3. Lithium	Light Red
4. Lead	Pale Blue
5. Calcium	Brick Red

Niels Bohr explained that each atomic spectra of elements indicates the transformation of energy within the atom. He concluded that the electrons as particle that are moving around the nucleus with fixed energy where he called as energy level. But in a more sensitive spectroscope finer lines are seen within each line of color. It means that each main energy level in an atom consists of sublevels. When the electron is on its ground state there is an absorption of energy, the electron jumps to a higher energy level. Then, as the electron goes back to its original energy level, it will release energy.



Main Energy levels in the Atom and their Sublevels.

Main Energy Level	**Sublevels**
1 or K	s
2 or L	s,p
3 or M	s. p, d
4 or N	s.p.d.f
5 or O	s.p.d.f
6 or P	s. p, d
7 or Q	s,p

The main energy level is made up of sublevels of energy in which the energy level is made up of one or more sublevels. Heisenberg's Uncertainty Principle states that it is not possible to determine the exact location and velocity of an electron in an orbital at the same time. But there is a probability that the electron will be in a certain region in an atom which is called as the electron cloud. It is also described as the region composed of negatives surrounding the nucleus associated with the atomic orbital.

The Quantum Mechanical Model was introduced by Schrodinger. This model shows how likely an electron can be found around the nucleus. It looks like a cloud of negative charges having a certain geometrical figure. The Quantum Mechanical Model also gives the information about the energy of the electron. It also describes region of space around the nucleus as consisting of shells it is also called the principal or main energy levels.

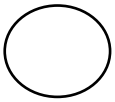
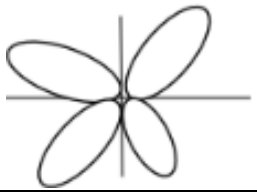
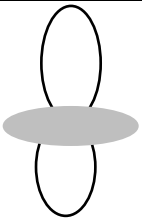
Principal Energy Levels and Sublevels of Electrons

Principal Energy Level (n)	Number of Sublevels	Type of Sublevels and number of orbitals	Maximum number of electrons
1	1	1s (1 orbital)	2
2	2	2s (1 orbital). 2p (3 orbitals)	8
3	3	3s (1 orbital), 3p (3 orbitals), 3d (5 orbitals)	18
4	4	4s (1 orbital), 4p (3 orbitals), 4d (5 orbitals), 4f (7 orbitals)	32
5	5	5s (1 orbital), 5p (3 orbitals) 5d (5 orbitals). 5f (7 orbitals)	50

There are different kinds of Quantum Numbers:

1. Principal quantum number (n) describes the energy level of an electron in an atom. It can be expressed using the letters of an alphabet like K, L, M, N, O, P and Q energy level.
2. Angular Momentum Quantum Number (l) it describes the way on how the electrons move around the nucleus. It determines the shape of an orbital.

Examples:

			
S orbital (l =0)	P orbital (l = 1)	d orbital (l = 2)	f orbital (l = 3)

3. Magnetic Quantum Number (m_l) it refers to the possible behavior of the electrons in a magnetic field. The m values are as follows:

	m_l	0 (no effect on the magnetic field
p orbital	m_l	+1, 0, -1
d orbital	m_l	+2, +1, 0, -1, -2
f orbital	m_l	+3, +2, +1, 0, -1, -2, -3

4. Spin Quantum Number (m_s) describes the rotations or the spins on how the electrons move on their own axis as they move around the nucleus. The spinning charge create the magnetic field that make the electron comparable to a magnet. The electron spinning clockwise has the - ½ values. The electrons that are spinning counter - clockwise have the + ½ values. You may use the table below as your guide or reference.

Quantum Number			Number of Possible Electrons
n	l	m	
1	1	s	2
2	2	s	2
		p	6
3	3	s	2
		p	6
		d	10
4	4	s	2
		p	6
		d	10
		f	14

Examples:

The possible set of quantum numbers for the electrons in 3s and 2p.

3s → n = 3 l = 0 m_l = 0 m_s = ½, - ½

2p → n = 3 l = 1 m_l = -1 m_s = ½, - ½

= 0 m_s = ½, - ½

=1 m_s = ½, - ½

Notes: S means sharp, P means principal, D means diffuse, F means fundamental

Rules Governing Electronic Configuration

1. The Aufbau Principle requires that the electrons occupy the lowest possible energy level before filling up the next.
2. Pauli's Exclusion Principle states that no two electrons can have the same set of four quantum number; the spin quantum number limits the number of electrons in an orbital to a maximum of two.
3. Hund's Rule requires that the electrons fill the orbitals in a sub level, one by one, before pairing the electrons in an orbitals spin in opposite direction.

Arrangement of Electrons in the atoms of the First 10 Elements

	O	**R**	**B I**	**T**	**AL**	
Chemical Symbol	1s	2s	$2p_x$	$2p_y$	$2p_z$	Electron Configuration
$_1$H	↑					$1s^1$
$_2$ He	↑↓					$1s^2$
$_3$ Li	↑↓	↑				$1s^2\ 2s^1$
$_4$ Be	↑↓	↑↓				$1s^2\ 2s^2$
$_5$ B	↑↓	↑↓	↑			$1s^2\ 2s^2\ 2p_x^1$
$_6$ C	↑↓	↑↓	↑	↑		$1s^2\ 2s^2\ 2p_x^1$
$_7$ N	↑↓	↑↓	↑	↑	↑	$1s^2\ 2s^2\ 2p_x^1\ 2p_y^1$
$_8$ O	↑↓	↑↓	↑↓	↑	↑	$1s^2\ 2s^2\ 2p_x^2\ 2p_y^1\ 2p_z^1$
$_9$ F	↑↓	↑↓	↑↓	↑↓	↑	$1s^2\ 2s^2\ 2p_x^2\ 2p_y^2\ 2p_z^1$
$_{10}$ Ne	↑↓	↑↓	↑↓	↑↓	↑↓	$1s^2\ 2s^2\ 2p_x^2\ 2p_y^2\ 2p_z^2$

You can also use the electron configuration to identify some of the information about the elements in terms of the following like the group number, the period number, the number of paired and unpaired electrons and also the valence electrons.

Example: Sodium (Na)

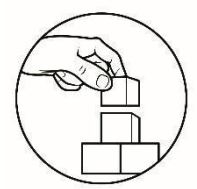
Electron configuration: $1s^2$, $2s^2$, $2p^6$, $3s^1$

Group Number: 1

Valence Electron: 1

Period: 3

Energy Level: 1

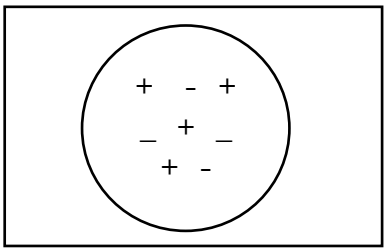


What's More

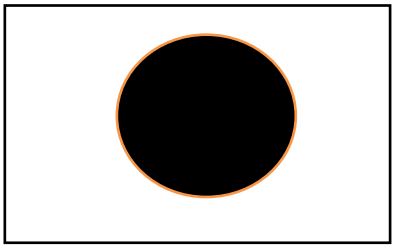
Activity 1: Who Am I?

Identify the following atomic model. Choose the correct answer from the box below and write your answer on a separate sheet of paper.

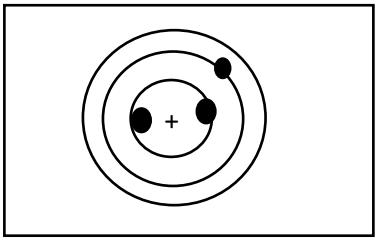
Ernest Rutherford (Nuclear Model)
Joseph John Thomson(Plum Pudding Model)
Niels Bohr (Planetary Model)
John Dalton(Solid Sphere Model)
Erwin Schrodinger (Electron Cloud Model)



1. _____

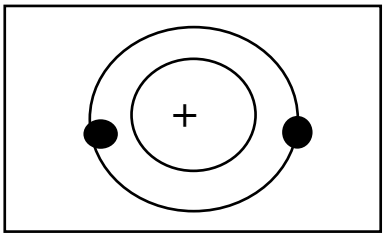


3. _____



2. _____

4. _____



5. _____

Activity 2: How's my Probability?

Using the pattern similar to the solar system and number of small buttons in solving Probability. Each button was dropped to the pattern many times. After that each button was counted. Now you will solve for the probability using the given data and answer the following guide questions below. Write your answer on a separate sheet of paper.

No. of Circle	Distance from the Center	Area of the Circle cm^2	Difference of the consecutive circle	Number of buttons in a circle	No. of buttons per cm^2 (Divide column 5 by column 4)	% of Probability of Finding the buttons (Multiply column 6 by 100)
1	2	3	4	5	6	7
A	4.0 cm	50.24	62.8	7	0.1115	11.15
B	6.0 cm	113.04	87.92	12		
C	8.0 cm	200.96	113.04	18		
D	10 cm	314.00	138.16	10		
E	12 cm	452.16	163.28	6		

Guide Questions:

1. What happens to the number of buttons as the distance increases?
2. How many buttons are found in the area with the highest probability?
3. Is the result of your simple activity similar to the distribution of electrons in an atom?
4. Based on the activity can you predict the exact position of the electrons of an atom?

Activity 3: Amazing Electron

A. Match column A to column B. Write the correct letter on your answer sheet

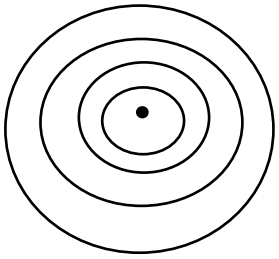
A	B
1. $1s^2, 2s^2, 2p^3$	A. Calcium (20)
2. $1s^2, 2s^2, 2p^6, 3s^2, 3p^4$	B. Chlorine (17)
3. $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$	C. Potassium (19)
4. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$	D. Sulfur (16)
5. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$	E. Nitrogen (7)

A. Opposite the boxes, write the electron configuration of the following elements.

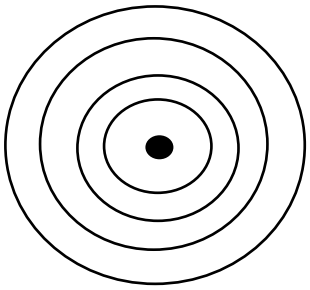
1. Bromine 35
2. Magnesium 12
3. Aluminum 13
4. Argon 18
5. Neon 10

C. Distribute the electrons in the main energy level using the given electron configuration.

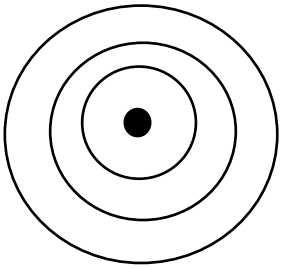
1. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$



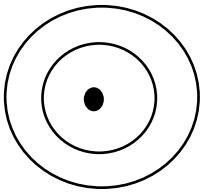
2. $1s^2, 2s^2, 2p^6, 3s^2, 3p^4$



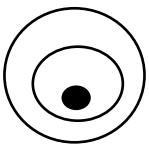
3. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$



4. $1s^2, 2s^2, 2p^3$



5. $1s^2, 2s^1$



Activity 4: My Quantum Numbers?

Identify the quantum numbers of the given elements. Write your answer on a separate sheet of paper.

Element	Atomic number	n	l	m_l	m_s	Name of orbital
Helium	2					
Lithium	3					
Be	4					
Boron	5					

Activity 5 Can You Make Me Complete?

A. Fill in the missing data to complete the table below.

Electron Configuration	Period No.	Grp. No.	No. of Valence	No. Of Unpaired Electrons	No. of Paired Electron
1. $1s^2, 2s^2, 2p^6$					
2. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^4$					
3. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$					
4. $1s^2, 2s^2, 2p^6, 3s^2, 3p^4$					
5. $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$					
6. $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$					
7. $1s^2. 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^4$					
8. $1s^2, 2s^2, 2p^6, 3s^2$					
9. $1s^2, 2s^1$					
10. $1s^2, 2s^2, 2p^1$					

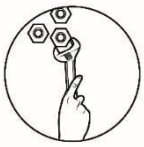
B. Identify the following:

1. Number of orbitals in the third energy level. _____
2. Maximum number of electrons that can occupy the first energy level. _____
3. The total number of electrons in the first and second energy level _____
4. Number of orbitals present in the first energy level. _____
5. The lowest value that the principal quantum number **n** may have. _____

What I Have Learned

Determine the word that correctly completes the statement. Write your answer on a separate sheet of paper.

1. _____ is the way in which the electrons are distributed in the different orbitals of an atom.
2. _____ is the region of space where the electrons are most likely be found.
3. _____ formulated a mathematical equation that describes the behavior of the electron. He used the probability of finding the electrons at a particular region in space around the nucleus of an atom.
4. _____ describes the atom as having the nucleus where the electrons are moving around.
5. _____ is the region with high probability of finding the negative charge called electrons.
6. The _____ requires that the electrons occupy the lowest possible energy level before filling up the next.
7. _____ refers to the dumbbell shape of an orbital with three orientations in space.
8. _____ refers to the types of quantum number that describes how the electrons move on its axis.
9. _____ is the total number of electrons that will occupy the third energy level.
10. _____ describes the way on how the electrons move around the nucleus.



What I Can Do

A. Complete the table about the needed information of the given elements. Write your answer on a separate sheet of paper.

Name of Element	Chem. Symbol	Atomic Number	Electron Configuration	E Dot Structure	Valence Electron	Group Number
Ex. Lithium (3)	Li	3	$1s^2, 2s^1$	Li ●	1	1
1. Carbon (6)						
2. Sodium (11)						
3. Oxygen (8)						
4. Beryllium (4)						
5. Chlorine (17)						

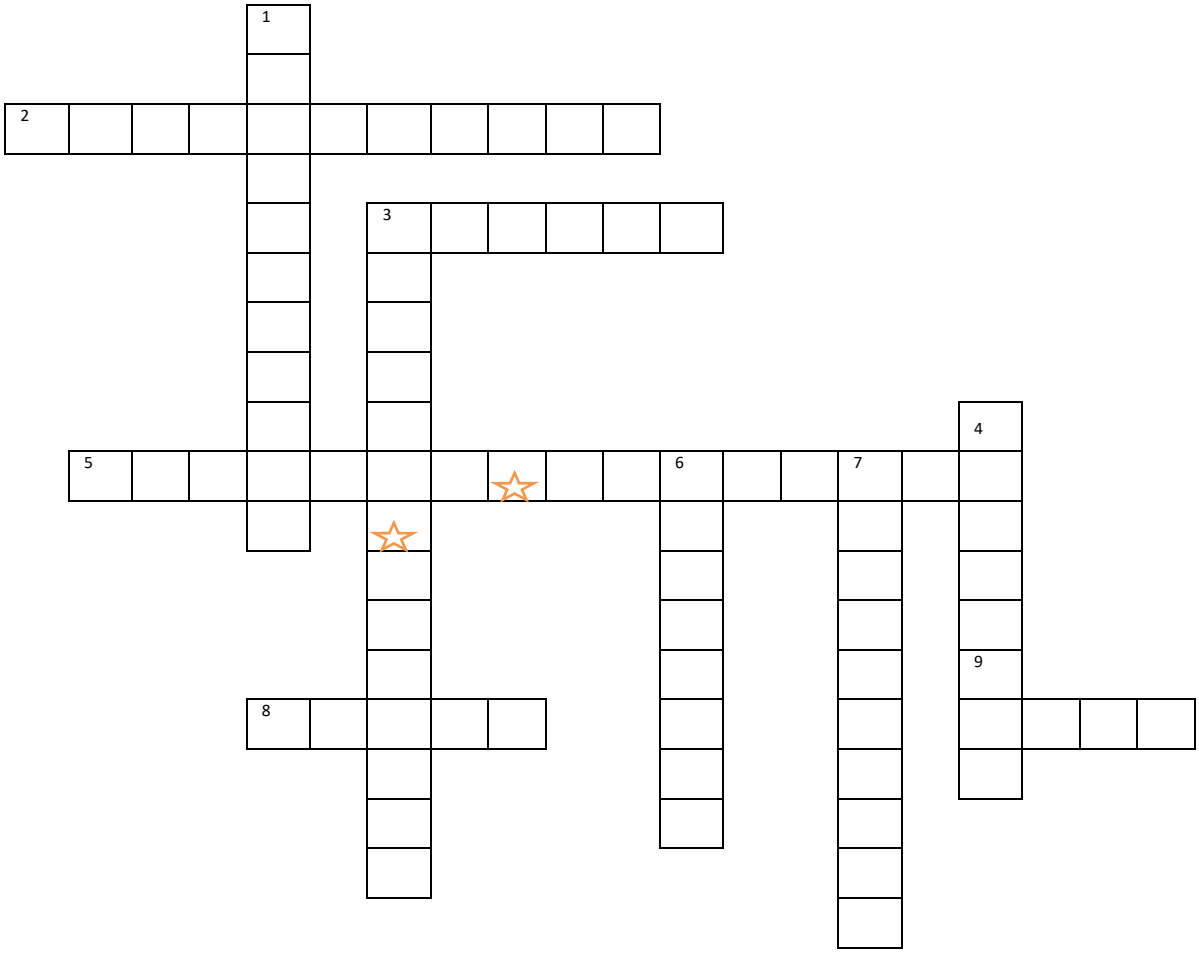
B. Answer the crossword puzzle below.

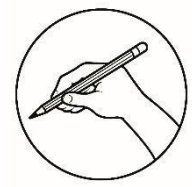
ACROSS

2. Wave particle model of atom.
3. Uncuttable
5. Electrons occupying the highest energy level.
8. Separates light into its component
9. Lewis Electron Dot Structure

DOWN

1. Represented by valence electron
3. Region on space where the Electron most likely found.
4. Refers to the excited electron.
6. Negative charged of atom.
7. Nuclear Model of atom





Assessment

Choose the letter of the best answer. Write your answers on a separate sheet of paper.

1. According to the Bohr model, how many electrons can the first orbital hold?
   A. 2
   B. 4
   C. 6
   D. 8

2. What happens to the energy of an electron when it jumps from an outer to an inner orbit?
   A. It is absorbed
   B. It remains constant
   C. It is emitted/released
   D. It could either increase or decrease

3. What is the name of the model of the atom that scientists use today?
   A. Billiard Model
   B. The Nuclear Model
   C. Plum Pudding Model
   D. Quantum Mechanical Model

4. Who described the electrons as waves that move in orbitals?
   A. Chadwick
   B. Rutherford
   C. Schrodinger
   D. Thomson

5. Who proposed the probability that electrons will be found in certain regions around the nucleus of an atom?
   A. Niels Bohr
   B. Ernest Rutherford
   C. Erwin Schrodinger
   D. Joseph John Thomson

6. Who states that "it is impossible to determine both the momentum and the position of an electron at the same time accurately"?
   A. Hund's Rule
   B. Aufbau Principle
   C. Uncertainty Principle
   D. Pauli's Exclusion Principle

7. Which occurs when an electron moves from high energy level to a low energy level?
   A. The atoms move faster
   B. Colored light is given off.
   C. This process is not possible
   D. Another electron goes from a low energy level to a high- energy level

8. How many orbitals are present in the third principal energy level?
   A. 2
   B. 3
   C. 6
   D. 9

9. What is the group and period of an element with an electronic configuration $1s^2$, $2s^2$, $2p^6$?
   A. Group II period 3
   B. Group 4 period 2
   C. Group 8 period 2
   D. Group 8 period 4

10. Which is the correct valence electron of element found in group 2 of the Periodic Table?
   A. $3p^1$
   B. $4s^2$
   C. $3p^5$
   D. $3s^2$. $5p^6$

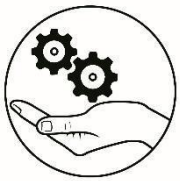
11. What happens to the momentum of an electron when it remains between orbitals?
    A. Emitted
    B. Quantized
    C. Dequantized
    D. Changed always

12. Which subshells can the electron with this quantum numbers n = 3, l = 2 be found?
    A. 1s
    B. 2p
    C. 3d
    D. 4f

13. Which does NOT have much allowed values for each of the four quanta numbers: n, l, m_l, and m_s ?
    A. m_l : -1 to 1
    B. l: 0 to n-1
    C. n: zero integer
    D. m_s: ½ or -½

14. How many orbitals of type (x) are found in a shell with n=2?
    A. 0
    B. 1
    C. 2
    D. 3

15. What is the lowest principal quantum number n may have?
    A. 0
    B. 1
    C. 2
    D. 3



Additional Activities

Write the electron configuration of the following elements. Then, write the valence electron and the group number. Write your answer on a separate sheet of paper.

1. Potassium (19)

VE	GRP.

3. Aluminum (13)

VE	GRP

2. Boron (5)

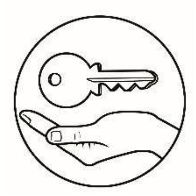
VE	GRP.

4. Neon (10)

VE	GRP.

5. Nitrogen (7)

VE	GRP



Answer Key

What I Know

1. D	6. A	11.B
2. B	7. C	12. C
3. C	8. D	13. B
4. D	9. B	14. D
5. B	10. D	15. B

What's In	**What's New**	
1.Neutral	1. D	4. B
2. Nucleus	2. F	5. E
3.Plum Pudding	3. A	6. C
4.Nuclear Model		
5.Electrons		

What's More

Activity No.1

PART A

1. Joseph John Thomson
2. Niels Bohr
3. John Dalton
4. Erwin Schrodinger
5. Ernest Rutherford

Activity 2

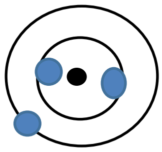
No. of Circle	Distance from the Center	Area of the Circle cm^2	Difference of the consecutive circle	Number of buttons in a circle	No. of buttons per cm^2 (5)/(4)	% of Probability of Finding the buttons
1	2	3	4	5	6	7
A	4.0 cm	50.24	62.8	7	0.1115	11.15
B	6.0 cm	113.04	87.92	12	0.1365	13.65
C	8.0 cm	200.96	113.04	18	0.1592	15.92
D	10 cm	314.00	138.16	10	0.0724	7.24
E	12 cm	452.16	163.28	6	0.0367	3.64

1. Decreases
2. 18
3. Yes
4. No

C.

1.

2



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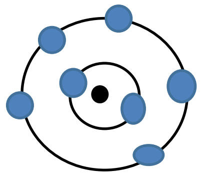

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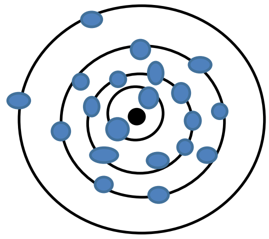

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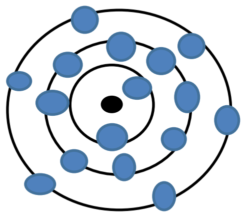
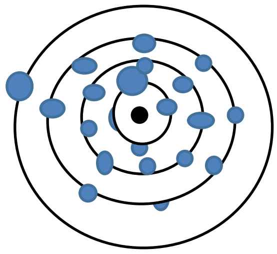




Activity 3

A.

1. E
2. D
3. B
4. A
5. C

B.

1. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^5$
2. $1s^2\ 2s^2\ 2p^6\ 3s^2$
3. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$
4. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
5. $1s^2\ 2s^2\ 2p^6$

Activity 5A

Electron Configuration	Period No.	Grp. No.	No. of Valence	No. Of Unpaired Electrons	No. of Paired Electron
1. $1s^2, 2s^2, 2p^6$	2	8	8	0	3
2. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^4$	4	6	6	2	1
3. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$	4	1	1	1	0
4. $1s^2, 2s^2, 2p^6, 3s^2, 3p^4$	3	6	6	2	1
5. $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$	3	7	7	1	2
6. $1s^2, 2s^2, 2p^6, 3s^2, 3p^4$	3	6	6	2	1
7. $1s^2. 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^4$	4	6	6	2	1
8. $1s^2, 2s^2, 2p^6, 3s^2$	3	2	2	0	1
9. $1s^2, 2s^1$	2	1	1	1	0
10. $1s^2, 2s^2, 2p^1$	2	3	3	1	2

Element	Atomic number	n	l	m_l	m_s	Name of orbital
Helium	2	1	0	0	+ ½ - ½	1s
Lithium	3	1	0	0	+ ½ - ½	1s
		2	0	0	+ ½	2s
Be	4	1	0	0	+ ½ - ½	1s
		1	0	0	+ ½ - ½	1s
		2	0	0	+ ½ - ½	2s
Boron	5	1	0	0	+ ½ - ½	1s
		2	0	0	+ ½ - ½	2s
		2	1	-1	+ ½	$2p_x$

Activity 4

What I Can Do

Name of Element	Chem. Symbol	Atomic Number	Electron Configuration	E Dot Structure	Valence Electron	Group Number
Ex. Lithium	Li	3	$1s^2, 2s^1$	Li •	1	1
1. Carbon	C	6	$1s^2\ 2s^2\ 2p^2$	C	4	4
2. Sodium	Na	11	$1s^2\ 2s^2\ 2p^6\ 3s^1$	Na •	1	1
3. Oxygen	O	8	$1s^2\ 2s^2\ 2p^4$	O	6	6
4. Beryllium	Be	4	$1s^2\ 2s^2$	Be	2	2
5. Chlorine	Cl	17	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$	Cl	7	7

Activity 5B.

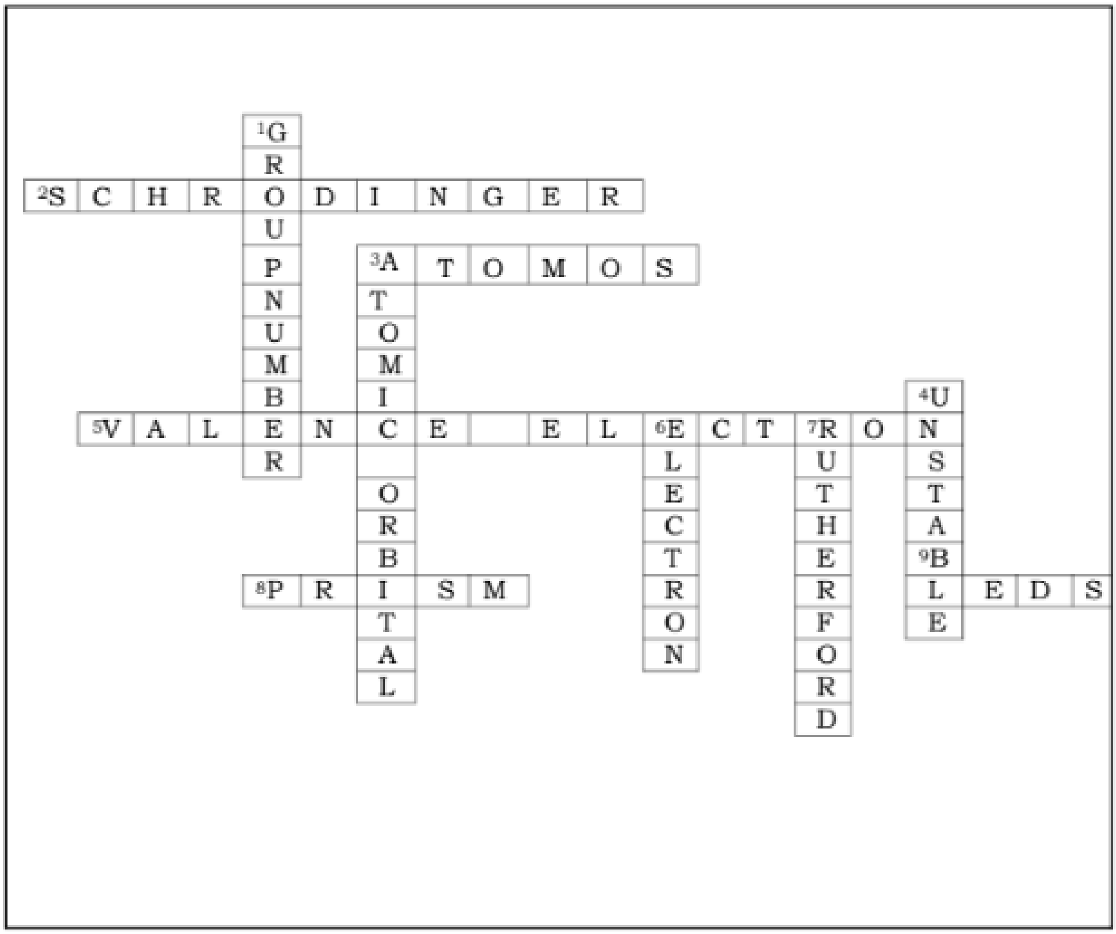
1. 9
2. 2
3. 10
4. 1
5. 1

What I Have Learned

1. Electron configuration
2. Atomic Orbital
3. Erwin Schrodinger
4. Quantum Mechanical Model
5. Electron Cloud
6. Aufbau Principle
7. p orbital
8. Spin quantum number
9. 18
10. Angular Momentum Quantum

Assessment:

A	11. B
C	12. C
B	13. C
C	14. B
C	15. B
C	
B	
D	
C	
10. B	



Additional Activities

1. Potassium (19)

   1s2 2s2 2p6 3s2 3p6 4s1

VE 1	GRP.1

2. Boron (5)

   1s2 2s2 2p1

VE 3	GRP. 3

3. Aluminum (13)

   1s2 2s2 2p6 3s2 3p1

VE 3	GRP. 3

4. Neon (10)

   1s2 2s2 2p6

VE 8	GRP. 8

5. Nitrogen (7)

   1s2 2s2 2p5

VE 7	GRP. 7

References

Books:

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